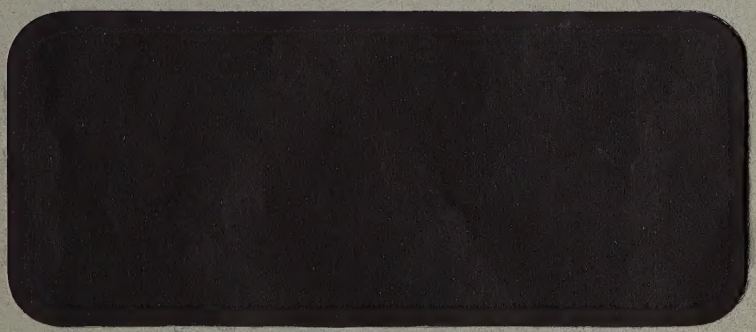
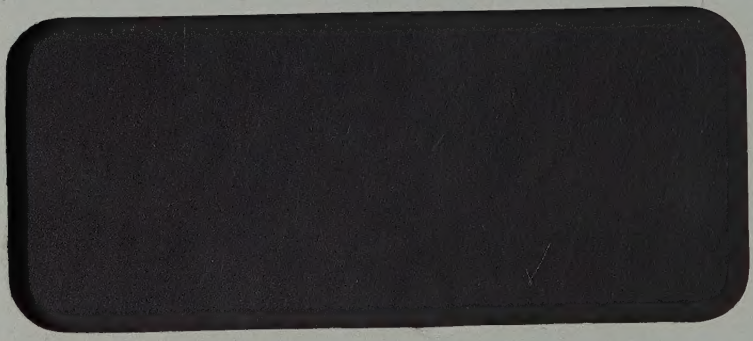
WAYNE KERR





A126

# BRIDGE SOURCES AND DETECTORS

S161 - S261 - R161 - R261

A127

INSTRUCTION MANUAL

The Wayne Kerr Laboratories Limited
Sales and Service,
44, Coombe Road, New Malden,
Surrey, England.

Telephone: MALden 2202
Telegraph: Waynkerr, New Malden

Wayne Kerr Corporation,
1633 Race Street,
Philadelphia 3,
Pennsylvania, U.S.A.

Telephone: LOcust 8-6820

CONTENTS


Page

BRIDGE SOURCES S161 and S261

General . . . . . 1
Performance Specification 2
Circuit Details . . . . . 3
Operating Instructions 5
Maintenance . . . . . 6

DETECTORS R161 and R261

General . . . . . 7
Performance Specification 8
R161 Circuit Details . . . . . 9
R261 Circuit Details 10
Operating Instructions . . . . . 11
Maintenance 12


NOTE: Due to continued development, the instruments may vary in certain details from the circuits shown in this handbook.

# BRIDGE SOURCES S161 and S261

## GENERAL

These Sources, with their associated Detectors, are intended for use with the Wayne Kerr Admittance Bridges and cover the frequency range 5Mo/s to 250Mc/s. The table below shows the appropriate combination:

| Frequency Range Mc/s. | Bridge Type | Source Type | Detector Type |
|---|---|---|---|
| 5 - 100 | B. 801 | S. 161 | R. 161 |
| 50 - 250 | B. 901 | S. 261 | R. 261 |

Each source has a self-contained power supply operating from 115V or 230V A.C. 40 - 60 c/s mains, or from batteries. Connexion to the bridge is made by a cable terminated at each end by a miniature coaxial plug.

The source is contained in a steel case, finished in black, and measures 8·75" by 8" front to back by 7" deep. The weight is approximately 13lb.

## PERFORMANCE SPECIFICATION

Each source is fitted with a three-position range switch:

| | S.161 | S.261 |
|---|---|---|
| Range 1: | 5 - 13 Mc/s | 50 - 80 Mc/s |
| Range 2: | 13 - 35 Mc/s | 80 -134 Mc/s |
| Range 3: | 35 -100 Mc/s | 134 -250 Mc/s |

The range in use is indicated by the lighting of a pilot lamp at the end of the scale, the lamp switching being coupled to the range selector switch.

The accuracy of scale calibration is 1 per cent. The source, in conjunction with its detector, gives adequate discrimination when connected to the appropriate bridge: 0·1 mmho for the B.901 and 0·025 mmho for the B.801.

The output from the source is amplitude-modulated at 1 kc/s to a depth of approximately 60 per cent and varies from 300 mV to 1·2 V r.m.s. according to the range in use. This output level, which is fixed for each range, is adjusted internally to provide an optimum signal which compensates for the changing insertion loss of the bridge.

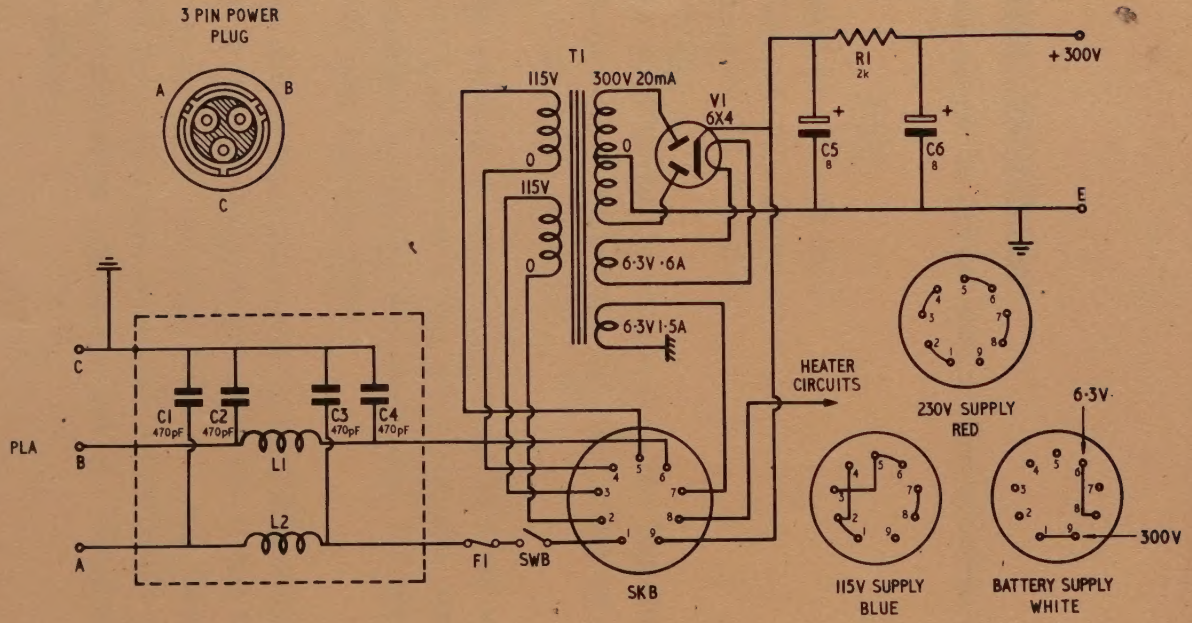



FIG. 1 POWER SUPPLY UNIT

(FROM DRGS. D2200/H, 2242/F, 2243/G, & WP3701)

## CIRCUIT DETAILS

### Power Supply

Both types of source are supplied from the mains rectifier circuit shown in Fig. 1. The mains input is through a 3-pin connector at the rear of the case. This connector is illustrated in Fig. 1 (top left) and the alternative connexions for mains and battery operation are as follows:

| Mains Operation | Battery Operation |
|---|---|
| A Live line | A Positive L.T. |
| B Neutral line | B Positive H.T. |
| C Earth pin | C Negative H.T. and L.T. |

The input passes through an encapsulated filter (shown within the dotted rectangle) to the fuse and switch.

Above the connector at the rear of the case is a 9-way plug and socket which enables the power supply to be obtained from H.T. and L.T. batteries or from a vibrator. The connexions to this socket are shown in Fig. 1, together with details of the three coloured plugs for the various input arrangements.

The primary winding of the mains transformer is in two halves which are connected in series or parallel for 230V or 115V operation, the interconnexions being made by inserting the appropriate plug in the multi-way socket.

The H.T. rectifier circuit is of the conventional type, using a 6X4 miniature full-wave rectifier and resistance - capacitance smoothing.

The nominal value of the smoothed h.t. is 300 volts but different loadings by the sources or detectors results in the exact value lying above or below this figure.

Oscillator Circuit.

The main oscillator is of the Colpitts type, using one half of a 12AT7 double triode $V_{3a}$ (Fig. 2.) The main tuning coils $L_3$, $L_4$ and $L_5$ together with the tuning capacitor $C_{16}$, are enclosed in a screening box. The tuning coil in use is selected by the range switch SWA2, adjacent coils being short-circuited to prevent unwanted resonance. The same switch is used to select the coupling coils $L_6$, $L_7$, $L_8$, the degree of coupling being pre-set for each range to give the required output. Another section of the switch controls the appropriate pilot lamps $LP_1$, $LP_2$, $LP_3$.

Modulator Circuit.

The modulator valve $V_2$ drives an R-C oscillator circuit $C_{10}$ - $C_{12}$, $R_7$ - $R_9$, which provides a sinusoidal signal at a frequency of approximately 1 kc/s. This is applied to the grid of the main oscillator through $C_{13}$, $R_{10}$ and $R_{11}$. The modulator valve is an EF.91.

The circuits of sources S161 and S261 are similar, with the exception of the coil constants in the tuning circuits and the tuning capacitors $C_{16a}$ and $C_{16b}$. In the Source S161, $C_{16}$ is 230 pF. maximum, and in S261 it is 50 pF. maximum.

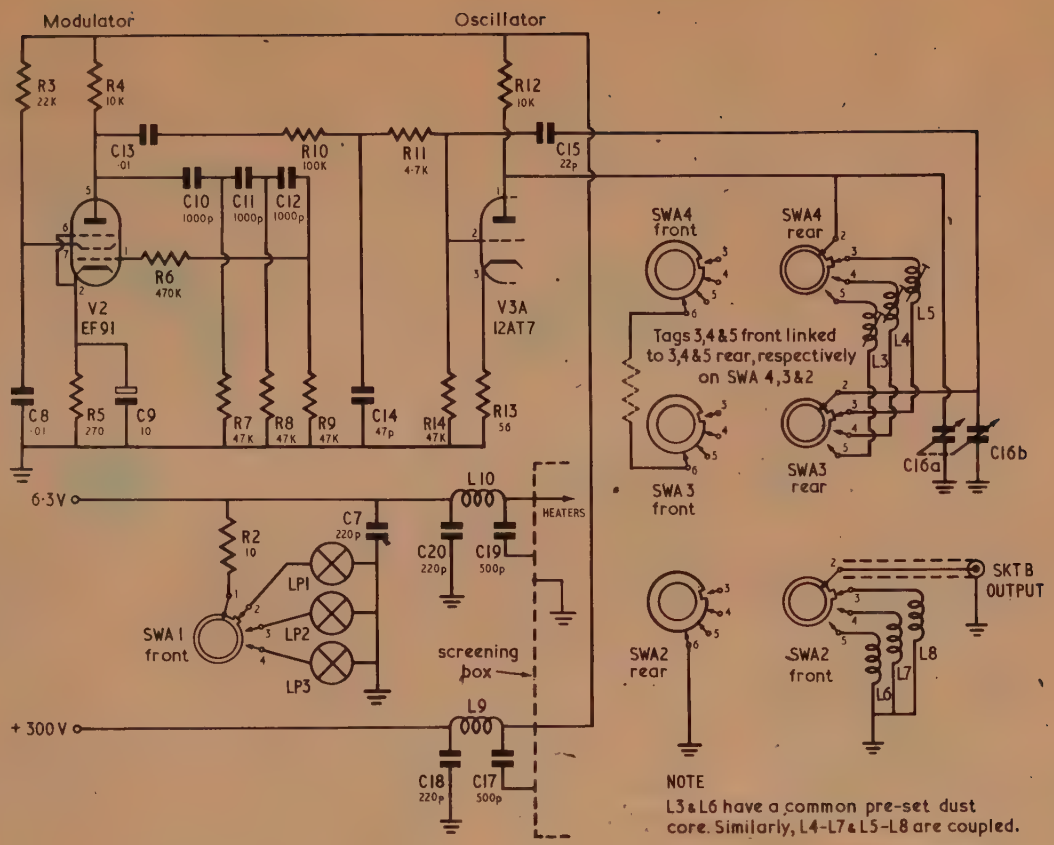



FIG.2 CIRCUIT OF BRIDGE SOURCES TYPE S.161 & S.261

(DRGS. 2243/G & WP3701/A)

## OPERATING INSTRUCTIONS

### Connecting-up

Check that the flexible lead to the mains plug is wired according to the appropriate tabulation given on page 3. It is important that a good earth connexion is provided.

If battery or vibrator supply is used, check that the correct multi-way plug is inserted.

Connect the source to the bridge by means of the coaxial cable, and the bridge to the detector by a similar cable.

Switch on and select the required range on the frequency dial.

Instructions for tuning the detector will be found on page 11. In the event of the pilot lamps not lighting, first check that the mains supply is on and if the instrument remains inoperative, disconnect it from the supply and examine the mains input fuse.

## MAINTENANCE

It is recommended that the tuned circuits should not be adjusted by the user. If the calibration becomes inaccurate the instrument should be returned to the factory.

### Valve Replacement

Access to the valves is obtained by removing the chassis from the case. To do this, unscrew the captive screws beneath the case and withdraw the chassis.

The rectifier valve (6X4) will be found immediately behind the mains transformer. The oscillator and modulator valves are inside the screened compartment, the cover of which can be removed by taking out the four retaining screws at the back of the compartment.

### Pilot Lamps

The three pilot lamps are held on a bracket secured to the main framework by a hexagon-headed screw which will be seen near the left-hand lamp. On withdrawing this screw the lamp bracket can be lifted clear of the light shield and the lamps are easily accessible. The rating of the lamps is 6·3V 0·3A.

### Fuse

This is mounted internally on the frame behind the mains input plug. The instrument must be disconnected from the mains supply before the chassis is removed. The fuse is a standard cartridge type rated at 1 ampre.

## BRIDGE DETECTORS R161 and R261

### General

These detectors have been designed to operate in conjunction with the signal sources and bridges specified on page 1. The R161 covers the frequency range 5 Mc/s to 100 Mc/s, and the R261 covers 50 Mc/s to 250 Mc/s.

Each detector has a self-contained power supply which can be operated from 115V, 230V, 40 - 60 c/s a.c. mains, or from batteries. Connexion to the Bridge is made by means of a coaxial cable terminated in miniature coaxial plugs.

The detector is contained in a steel case, finished in black. The dimensions of the case are similar to those of the source:

8·75" by 8" front to back by 7" deep. The weight is 11 lb.

Performance Specification

Each detector is fitted with a three-position range switch:

| | R161 | R261 |
|---|---|---|
| Range 1: | 5 - 13 Mc/s | 50 - 80 Mc/s |
| Range 2: | 13 - 35 Mc/s | 80 - 134 Mc/s |
| Range 3: | 35 - 100 Mc/s | 134 - 250 Mc/s |

The range in use is indicated by the lighting of a pilot lamp at the end of the scale, the lamp switching being coupled to the range selecting switch.

A logarithmic gain control is mounted on the front panel. On detector R161 this control forms part of the i.f. amplifier chain. On R261 the control operates on the a.f. amplifier.

The audio frequency output is taken from a phone jack on the front panel. Headphones of 2000 ohms resistance should be used or, if visual indication is preferred, a sensitive milliwattmeter or valve voltmeter may be connected to the jack.

The receivers are sensitive over the greater part of their range to 5μV for unity signal/noise ratio. The highest range of the R261 (134 - 250 Mc/s) has a lower sensitivity (10 - 15μV), but the output from the source has been increased to compensate for this reduction.

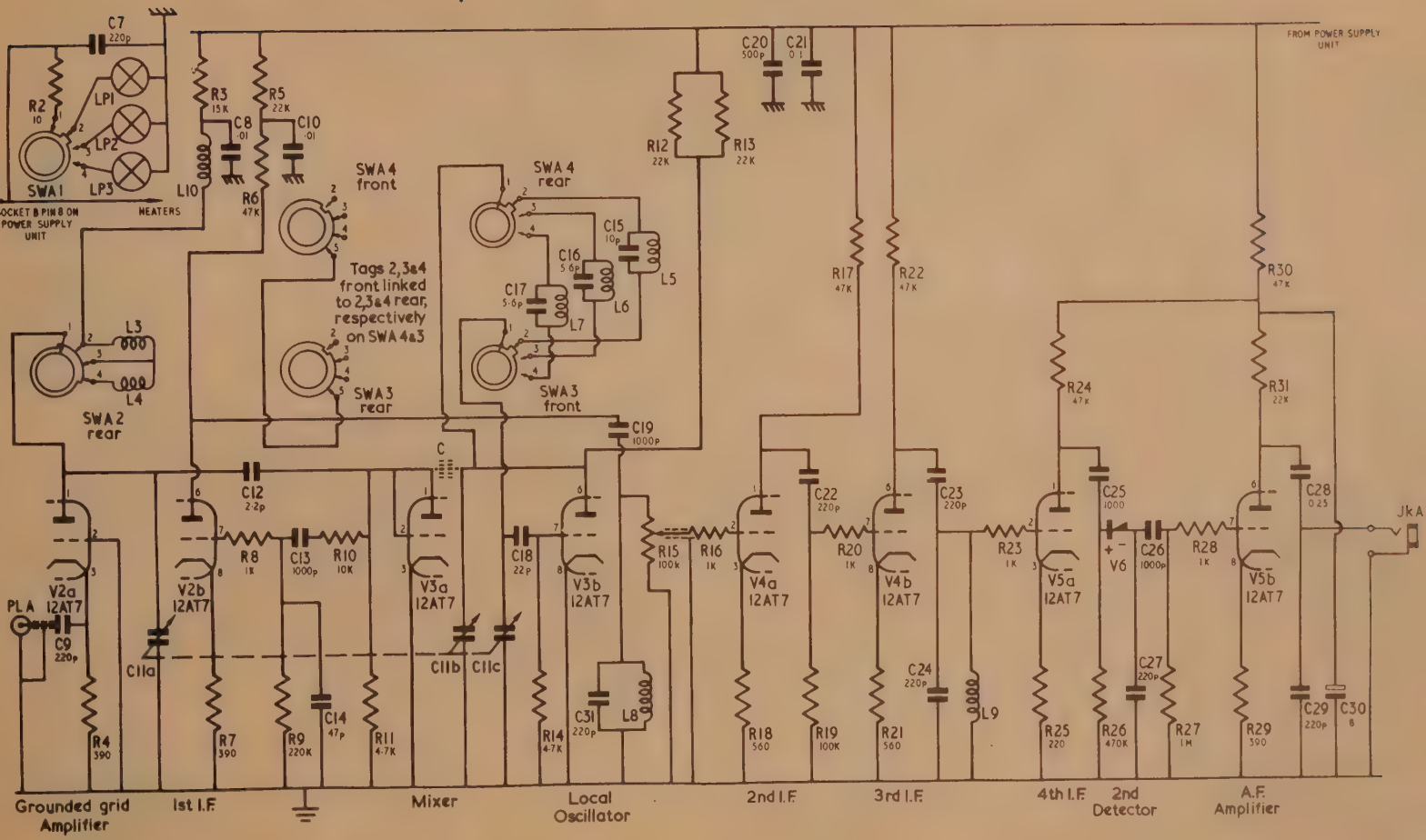



FIG. 3. CIRCUIT OF BRIDGE DETECTOR TYPE R161.

## R161 Circuit Details

Refer to the circuit diagram (Fig. 3). The signal from the bridge is injected into the cathode of a grounded-grid amplifier $V_{2a}$ ($\frac{1}{2}$ 12AT7). The anode circuit is tuned by the coils $L_3$, $L_4$, and $C_{11a}$, and the tuned signal is fed to the mixer, a triode connected as a diode, by the small capacitor $C_{12}$.

A portion of the twin triode $V_{3b}$ forms the local oscillator, a Colpitts tuned circuit containing L5 $C_{15}$, L6 $C_{16}$, L7 $C_{17}$ and variable tuning provided by $C_{11}$ b and c. The output from this oscillator is fed to the diode-connected mixer by coupling which includes the capacitance of the valve bases (C, shown dotted).

The output of the mixer is fed to the four-stage i.f. amplifier. The gain control (R15) precedes the second stage. The tuned circuit $L_9$, $C_{24}$, is tuned to 150 kc/s. The second detector ($V_6$) is a germanium rectifier and this is followed by an audio-frequency stage $V_{5b}$ ($\frac{1}{2}$ 12AT7).

R261 Circuit Details

Refer to the circuit diagram (Fig. 4). The signal from the Bridge is injected into the cathode of a grounded-grid amplifier V1a ($\frac{1}{2}$ 12AT7). The anode load of this stage is also the tuned circuit for the local oscillator. This is a Colpitt's circuit, using V1b. The grounded-grid amplifier (V1a) prevents the oscillator radiating.

The combined signals (from the grounded-grid amplifier and the local oscillator) are fed to the mixer stage (V2a). The anode circuit of this stage is tuned to the intermediate frequency employed in the R261, which is centred on 1·6 Mc/s.

The intermediate-frequency signal is coupled from the mixer to the i.f. amplifier stage (V3a). The signal is detected by MR1 and the resultant modulation fed to the a.f. amplifier (V4 and V3b). The sensitivity control (RV1) is a potentiometer connected between the two stages of the a.f. amplifier. The output from V3b is applied to the phones jack.

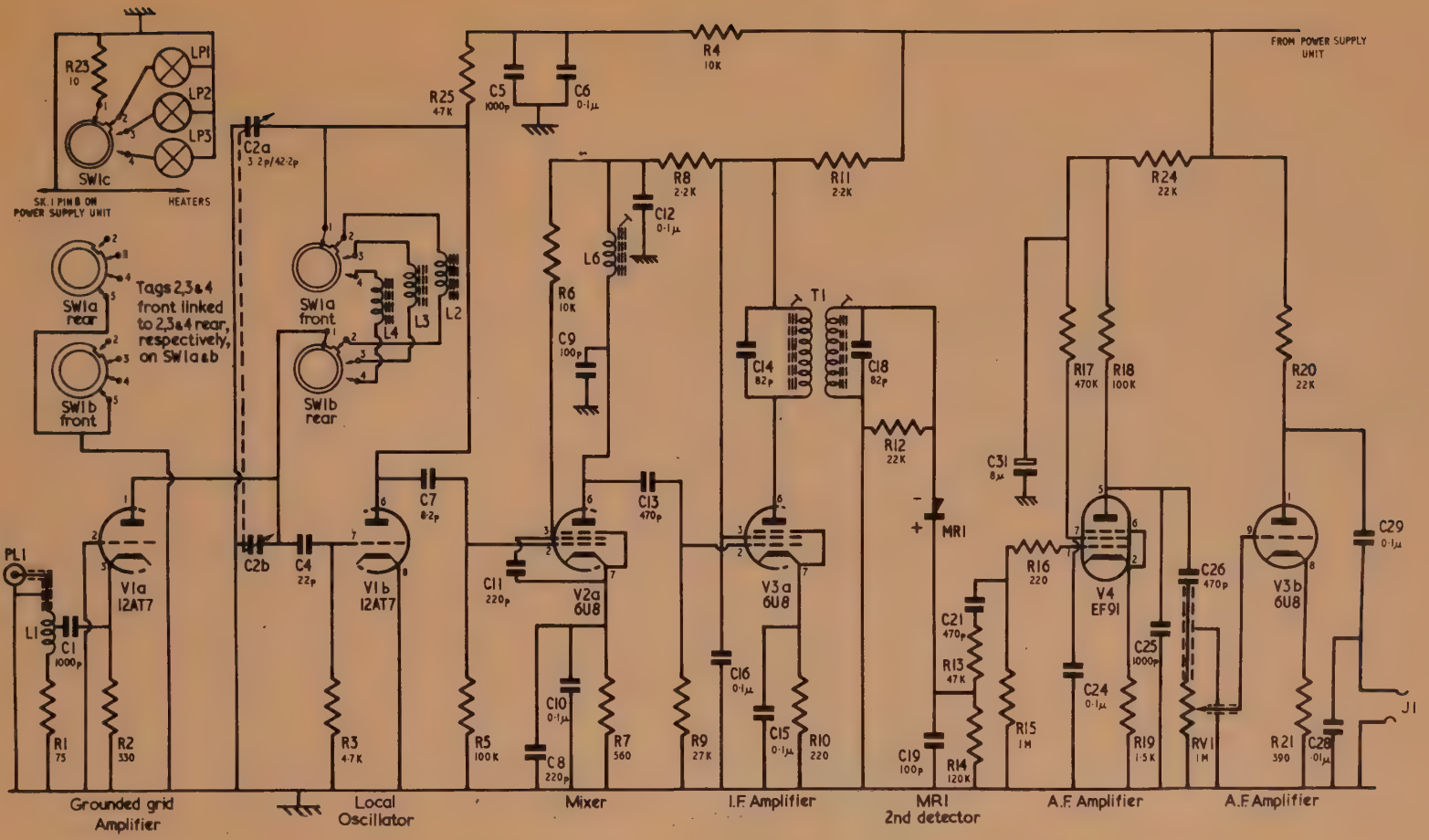



FIG. 4. CIRCUIT OF BRIDGE DETECTOR TYPE R.261 (DRG. D.2200/H)

## OPERATING INSTRUCTIONS

The bridge detectors are connected to the a.c. mains supply in the same manner as the sources (see page 5).

Connect the source and detector to the bridge, using coaxial cables.

When the source has been set to the required measurement frequency, adjust the receiver sensitivity control to its approximate mid-position and tune the receiver for maximum volume in the 'phones. The bridge can now be balanced in the usual manner, the receiver sensitivity being increased as necessary.

## MAINTENANCE

The information on page 6, relating to the sources, applies also to the detectors, although any calibration inaccuracy is not so important.

The detectors can be checked for sensitivity and bandwidth against the performance figures given below. These are typical results and some variations are to be expected.

| Range | Frequency | Input for 1mW O.P. into 4000Ω | Input for Unity Sig./ (Noise and Hum) Ratio |
|---|---|---|---|
| | | Not greater than: | Not greater than: |
| 3 | 225 Mc/s | 25 µV | 10 µV |
| 3 | 145 Mc/s | 200 µV | 30 µV |
| 2 | 145 Mc/s | 35 µV | 10 µV |
| 2 | 100 Mc/s | 160 µV | 25 µV |
| 1 | 80 Mc/s | 50 µV | 10 µV |
| 1 | 50 Mc/s | 200 µV | 30 µV |

| | |
|---|---|
| I.F. Bandwidth (-3dB) | 350-1800 c/s |
| I.F. Bandwidth (-6dB) | Approx. 140 kc/s |
| I.F. Gain from grid of mixer V2a to input of V4 (Input signal modulated 30 per cent) | 54dB |
| A.F. Gain from grid of V4 to output (with 4000Ω load). | 46dB |
| Intermediate Frequency | 1•6 Mc/s. |

www.manualsplus.com
1004028